This passage induced me to submit to the trial and judgment of my fellow-members of the Physical section of the Royal Academy a very simple hypothesis regarding the nature of the Corona, which entered my mind shortly after the observation of the total eclipse of August 18, 1868.[*]

I think—and, if I am not mistaken, all astronomers agree with me—that a part of the luminous phenomenon which we call the Corona belongs to an atmosphere of the sun,[†] having a feeble reflecting power, or being itself luminous. But the beams in the Corona, whose variability is now confirmed anew, are necessarily an optical phenomenon. They originate, I believe, in the inequalities of the moon's surface. If the sunlight slants somewhere along the moon's limb through a *valley*, we observe from our point of view a *beam*, provided there exist between the moon and us particles able to reflect the sunlight, or to transmit it like semi-transparent bodies. There is no need to have recourse to diffraction.

To look for these particles in the atmosphere of the earth, as Mr. Gould does, is, in my opinion, not tenable, as the Corona and the beams have also been observed in eclipses, where the cone of the shadow even had[‡] a breadth of thirty-six German leagues. The molecules of the atmosphere, which we see around the eclipsed sun, are wholly within the cone of the shadow.

These reflecting particles are undoubtedly to be looked for beyond our atmosphere, between the moon and the earth, and I believe that they may be regarded as identical with those particles which float in the ether, and under other circumstances cause the zodiacal light.

That the zodiacal light, or rather the particles which cause it, reach the earth's orbit, is, as regards nearly its whole circumference, not subject to any doubt, as the apex of the zodiacal light is "mostly farther off the sun than 90°. Only in the months of March and April is it not possible to follow the zodiacal light so far" (Schmidt, "Das Zodiacallicht," Braunschweig, 1856). But then, at those particles which are situated on the apex of the zodiacal light, the sun's ray makes a right angle with the line which joins the earth, and the circumstances are not favourable for small and widely-dispersed particles to reflect much sunlight in the direction of the earth. It is, therefore, probable that in March and April these particles would show themselves farther from the sun if the illumination were stronger. At a total eclipse of the sun that angle is 179¼° for a particle visible at 30′ distance from the moon's limb, and 179¾° for particles in the immediate neighbourhood of the moon's limb; and it is an acknowledged fact that, under these circumstances, there is much more light reflected than if reflected at a right angle. Moreover, the intensity of the transmitted light increases equally with this angle.

Schmidt mentions, in his above-quoted work, that he and other observers, during the total eclipse of July 28, 1857, looked out for the zodiacal light, but in vain. He thought the sky not dark enough, and expresses himself as follows:—"Das Ansehen der den schwarzen Mond umgebenden vielstrahligen Corona war im ganzen betrachtet nicht gerade geeignet, sie *sogleich* in Beziehung zum Zodiacallichte zu denken."

Thus it seems that the beams made Schmidt conclude, "This is no zodiacal light." If my explanation is the true one, and if the sun's atmosphere is accepted as unlimited, and gradually passing over into the ether, then the light of the Corona, which equally surrounds the moon, falls altogether into the same category as the beams, only that it originates in the reflecting particles beyond the moon. Accordingly, my hypothesis is expressed thus: *Both the Corona and its beams have the same origin as the zodiacal light.*

I remark, finally, that the strangely curved form of some beams, as well as their variability, may be very well accounted for on this hypothesis—the curved form by the irregularity of the moon's surface. For instance: I take a particle of light of a beam of the Corona; I imagine myself in the molecule which, according to my hypothesis, corresponds with that particle of light, and which is situated between the moon and my eye. Looking, then, from that stand-point to the moon, I must see the light of the sun slanting over a valley; but if I move myself laterally—*i.e.* in the direction parallel to the moon's radius which corresponds with that valley—then it is not certain that I shall see on the same point an extraordinary amount of light, for it is possible that at the same place a ridge has intervened. It is, however, very possible that, if I move in a direction perpendicular to the former (and also perpendicular to the direction towards the earth), I come into a region where that ridge does not intervene, but where the continuation of the valley is again visible, through which the sunlight slants. In this case, the beam of the Corona—*i.e.* the effect produced by those particles which receive more light than others at equal distances from the surface of the cone, having its apex in the eye, and which surrounds the moon—has a curved form.

The variability is, I think, satisfactorily explained by the motion of the moon passing by the sun.

This hypothesis forced itself upon me when at Toli-holi[*] I saw the moon rising behind a hill. Before she made her appearance her light shone over the trees, and produced, in a hazy air on my side of the hill, beams which very much resembled those of the Corona. I do not know whether the zodiacal light has already been analysed by the spectroscope; if so, the comparison of the spectra of zodiacal light and the Corona will serve to test my hypothesis.

A second test is this: total eclipses observed in the months of December and January should show less brilliant beams than total eclipses observed in other months, since in December and January the earth is near the direction of the perihelion of the circumference of the zodiacal light. The next total eclipse of December 12, 1871, will perhaps give some information on this point.[†] J. A. C. OUDEMANS

Batavia, Sept. 2

The Fuel of the Sun

IN your impression of October 6 Mr. Murphy adds another to the frequent attempts that are still made to galvanise the expiring hypothesis that attributes the solar heat and light to a meteoric bombardment. Many very strong and sufficient objections have been already brought against it, but as Mr. Murphy states that he is "not mathematician enough to form any opinion on the merits of the controversy," I will add two arguments which to my mind are quite sufficient to annihilate this explanation—both of which may be sufficiently understood without mathematics, and neither of which have I ever seen fairly stated.

1st. The advocates of the meteoric bombardment usually start from the fact that great meteoric showers fall upon the earth. Thus, Dr. Tyndall, in his lectures on "Heat considered as a Mode of Motion," introduces Mayer's hypotheses, with an account of the number of meteors counted during the August and November showers; and these observed meteors and a few comets are the only actual observed material upon which this bombardment theory rests—all beyond them are mere figments of mathematical imagination, and any supplies derived from the zodiacal light, or otherwise exclusively from the space within the earth's orbit, must have been exhausted within the period of human existence.

Now, it is quite obvious, without any detailed calculation, that if these meteoric bodies, coming from anywhere you please outside of the earth's orbit in sufficient quantities to maintain the heat and light of the sun, had fallen, as they must have done, upon the earth in a proportion due to its magnitude and position, they must in the course of a few millions of years—say from the era of the Laurentian rocks to that of the London sewage deposits—have covered the earth with a very important superficial stratum, instead of merely supplying a few rare specimens for our museums. Every slowly deposited sedimentary rock upon the face of the earth should be thickly peppered and conglomerated with meteoric dust and nodules. With these considerations and the well-known geological facts before us, I need scarcely state the obvious conclusion, viz. that the evidences in support of the theoretical terrestrial requirements of this bombardment hypothesis are contemptibly insufficient.

My second objection attacks the fundamental basis of this hypothesis, and I think destroys it altogether. I maintain that any explanation of the sources of solar light and heat which does not equally and necessarily account for the radiations of all the other self-luminous orbs that people the whole immeasurable depths of space, is philosophically worthless. It is thus worthless if it does not also account for the perpetual renewal, the constancy, the eternal permanence, of all these radiations. The pale nebulæ, as well as the brighter suns, should be equally included in its grasp.

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[*] At the Island of Mantawalu-kéké (near Celebes), where I had the pleasure of meeting the Commander (Captain Bullock) and the Etat-Major of H.M.S. *Serpent*, and the Spanish astronomers of the municipal Athenæum at Manilla, the fathers Faum, Nonnell, and Ricardo.

[†] This is probably the Chromosphere, as seen in the Eclipse.—ED.

[‡] (*Subintellige*): at the surface of the earth.

[*] *Vulgo*, erroneously, Tontoli, north coast of Celebes.

[†] We hope also something from next month's eclipse.—ED.

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Tested thus broadly and philosophically, the meteoric bombardment hypothesis appears in its true colours as a monstrous physical absurdity. It assumes a perpetual flow of solid masses *converging* continuously from everywhere towards everywhere; or otherwise a state of things which could only endure through the time which these meteoric masses would occupy in travelling the semi-distance between the neighbouring suns. These little journeys ended, the interstellar space must, according to this hypothesis, become a sterile vacuum, all the lights of heaven must go out, eternal darkness must rest upon the face of the deep, and everlasting death pervade the universe.

W. MATTIEU WILLIAMS

The Cockroach

I HAVE only to-day noticed the Rev. C. J. Robinson's letter on this subject in your issue of the 29th Sept. A friend of mine, whom I have known all my life, who occupied an important trust as Bank Manager in India last year, and who is at present home on sick leave, assures me that Dr. Norman Macleod is wrong when he denies the nail-nibbling propensities of the cockroach. My friend had been in Kurachee for some time, and on his journey from that town to Bombay by sea he was annoyed one night in his berth by some insect crawling over his face; half asleep and half awake he put up his hand to his face and sent the insect to the foot of his berth. Shortly after he was awoke by a pain at his great toe, and on looking at it he discovered that a cockroach had nibbled off all the nail down to the quick.

JAMES DURIE

Aberystwith, Oct. 8

Were Cockroaches known to the Ancient Greeks and Romans?

YOUR correspondent, Rev. C. J. Robinson, drew attention in your columns (NATURE, Sept. 29) to the question whether these troublesome insects were known to the Ancient Greeks and Romans; he says, "there is a good deal to lead one to suppose that the *μυλακρίs* mentioned by Aristotle, and the *Blatta pistrinorum* of Latin writers was the same as our loathsome pest." I think Mr. Robinson is mistaken in supposing that the *μυλακρίs* is mentioned by Aristotle, at least I can find no mention made of this insect in the writings of the Stagirite. The word *μυλακρίs*, meaning some kind of insect, occurs in the fragments of Aristophanes preserved by Pollux, who amongst other meanings of the term gives the following one :— *ζῶόν η ἐν τῷ μύλωνι γινόμενον*, and then quotes this couplet from Aristophanes,

Ἵνα ξυνῶσιν ᾧπερ ἥδεσθον βίῳ,
Σκώληκας ἐσθίοντες, καὶ μυλακρίδας.

"where they may partake of the food of which they are fond, eating worms and *mylacrides*." It would not be possible to say what the *μυλακρίs* here denotes, but from the creature being often produced in mills, it may possibly mean a "Cockroach," though a "meal-worm" (*i.e.*, the larva of the beetle, *Tenebrio mulitor*) would suit equally well. The Greeks, however, had a word which may well represent the Cockroach, though it is even here impossible to speak with certainty. The word, *σίλφη*, it is probable denotes this insect. Aristotle (Hist. Anim. viii. 19. § 4) uses the word once; he enumerates the *silphe* amongst insects which cast their skins. The Scholiast in the "Peace" of Aristophanes says the *silphe* is an ill-smelling insect (*δυσώδμος*). Aetius (8. 33.) speaks of "the fat of the stinking *silphe* which inhabits houses." The epigrammatist Evenus (Analect, i. p. 167) speaks of the *silphe* of the booksellers' shops, and applies to it the epithets, page eating (*σελιδηφάγος*), destructive (*λωβήτειρα*), black-bodied (*μελαινόχρως*)." Lucian speaks of the mere book collector as providing pastime for mice and habitations for *silphe*, and cuffs his slaves for not keeping the mice and *silphe* away. (Advers. Indoct, iii. 114, Ed. Hemsterhus). The Scholiast here gives a description of the *silphe* which Schneider with some reason refers to some kind of *Lepisma*. Ælian (H. A. i. 37) says that the *silphe* infest swallows' nests; these cannot be cockroaches. Galen and Paulus Aegineta apply the epithet, *βδέουσαι*, to the *silphai*. Dioscorides (ii. 38) says that the inside of the *silphe* found in bake-houses when pounded with oil is good for pains in the ear. This leads me to the *Blatta* of the Romans. "On pulling off," says Pliny, "the head of a *blatta* it gives forth a greasy substance, which, beaten up with oil of roses, is said to be wonderfully good for affections of the ears." He speaks of the disgusting nature of this insect, one kind of which is known by the name of *Myloecon*, and found in mills (Nat. Hist. xxix. 39). In another place (xi. 34) Pliny says, "It is the nature of the *blatta* to seek dark corners and to avoid the light; they are very often found in baths." According to Virgil, "the light-avoiding *blattæ*" find their way into bee-hives (Geor. iv. 243). Horace (Sat. ii. 3, 119) ridicules an old miser for sleeping on straw and leaving his bed clothes in his chest, the food of *blattæ* and *tineæ*, "Blattarum ac tinearum Epulæ." Martial (Lib. iv. Ep. 37.) says unless his books are well put together they become the prey of *tineæ* and *blattæ*.

Constrictos nisi das mihi libellos
Admittam tineas trucesque blattas.

From the above passages it will be seen that the *blatta* was a destructive insect to clothes, books, &c., that it avoided the light, and was fond of warm places, that it frequented mills and exuded a greasy substance from its head, that it was a disgusting creature (probably in allusion to the smell) all of which particulars are true of cockroaches, and as there are many species of the family, and are widely distributed over all parts of the globe and must have been known to the ancients, I think there is good reason for concluding that the cockroach was known to the Greeks by the name of *σίλφη*, and to the Romans by that of *blatat*.

W. HOUGHTON

The Aurora Borealis

I SHALL be obliged if you will put on record a few scattered notes which I took of the splendid Aurora Borealis of October 25, seen from Arthingworth, Northamptonshire. When I first observed it at half-past five P.M., a crimson glow extended in an irregular band from N.N.E. to W., most prominent at about 20° to 30° above the horizon. This increased in height and breadth until it nearly reached a point S.W. of the zenith, and about 15° W.N.W. of the star Vega. At this time the northern part of the sky was perfectly free from aurora; gradually that part and the whole dome of the heavens, with the exception of a section from W. to nearly S., became filled with luminous streamers. These, for about 20° on each side of N., were white, the others crimson striped with white or rather greenish light, but the green I believe to be an effect of contrast, as where similar streamers were distant from the red light they were white.

The white or green steamers appeared to eclipse the red light, they changed their size, shape, and position, while the red continued comparatively unchanged. There were also dark streamers which, at first, I believed to be mere spaces without light, and to be caused by the darkness beyond, but I became ultimately convinced (as far as one could be convinced by appearances so subject to illusion) that they formed a part of the phenomenon itself. These streamers or long brushes could be seen beyond and clear of the luminous portion of the aurora, leaving the normal light of the sky between them and it, and hanging like long horse-tails, or like the fringes of rain seen on the edges of a distant rain cloud; changing their shape and position just as the luminous streamers are seen to do.

The most remarkable part of the phenomenon, however, was the circle of sky, or what may be called the pole of the aurora, to which the streamers converged. It appeared to embrace about from 7° to 10° of space. To an ordinary observer it might have appeared occasionally to shift its position to some extent, but, as far as I could judge during an hour's observations, this was not really the case, flickerings at times covered portions of it, and at other times the whole became faintly luminous; but by marking its position with reference to some small stars, this seemed to me to be unaltered. Most singular were the terminations of the streamers they culminated at this circle, not being undefined or gradually evanescent, but having angular tips far brighter than the portions immediately beneath, the nearest illustration to which I can give is an inverted fish-tail or bats-wing gas burner, except that this gives a feeble light at the point, while the aurora tips were whitest and brightest there, the streamers now fading off, and now becoming brighter and tinged with red as they got to 40° or 50° from the horizon; the tips varied constantly, but preserved the mean distance from the pole or focus of the aurora. The position of this was, as far as I could ascertain without star maps or instruments for observation, about 15° W.N.W. of Vega. The convergence of the beams was not in appearance conical, but dome or cupola shaped; this was, however, in all probability an optical illusion. Whether

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